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Oak Ridge Health Study Document Summary Form

DOCUMENT TITLE: Maximum External Radiation from a Radioactive Cloud at a Distance of 20 Miles from the Tower Shielding Reactor

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AUTHOR(S): H.M. Roth

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DOCUMENT CATEGORY

AI [DL dr dc da] [ED ea ew es ef] EP [HO hp hr hs hw] IN IP [ST (sa) sw ss] TM WP

Primary category - circle once; Secondary category (optional) - circle twice. Circle only one in a bracketed group.

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KEYWORDS:
Tower Shielding Reactor
external radiation

ABSTRACT:
Letter presenting the total integrated dose received at a distance of 20 miles from the Tower Shielding Reactor, due to a radioactive clouds.

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REVIEWER: G M Bruce DATE REVIEWED: 5/7/96

Classification Categories

UNK Classification Status Unknown
UNC Unclassified
OUO Official Use Only
UCNI Unclassified Controlled Nuclear Information
CL Classified

Categories of Classified Information

RD Restricted Data
NSI National Security Information
FRD Formerly Restricted Data

Levels of Classified Information

CONF Confidential
S Secret
TS Top Secret

Areas of Interest

K K-25 (ORGDP) Site
X X-10 Site / ORNL
Y Y-12 Site
S S-50 Site (Thermal Diffusion Plant)
ORR The Oak Ridge Reservation
MELT The Melton Hill Reservoir (Clinch from Solway bridge to Melton Hill Dam)
CLIN The Clinch River from Melton Hill Dam to the confluence with the TN River
WOC White Oak Creek
WOL White Oak Lake (White Oak Creek above White Oak Dam)
POPL Poplar Creek (Above the confluence with the East Fork)
EFPC East Fork Poplar Creek
PCE Poplar Creek Embayment (Poplar Cr. below the confluence of the East Fork)
BEAR Bear Creek
WATT Watts Bar Reservoir (the TN River from the confluence of the Clinch to Watts Bar Dam)

Document Categories

AI Accident and Incident Information
DL Demographic and Land Use Information
- **dr** residential (e.g. census data)
- **dc** crops (e.g. pasture, gardens, commercial crop production)
- **da** animals (e.g. beef and dairy cattle, game fish)

ED Environmental Monitoring and Research Data
- **ea** airborne contaminants
- **ew** waterborne contaminants
- **es** soil or sediment contaminants
- **ef** food product contaminants

EP Exposure Pathway Information (e.g. parameter references or assessments by others)
HO Historical Operations Information
- **hp** production activities (including pilot plant operations)
- **hr** research activities
- **hs** support activities
- **hw** waste disposal activities

IN Records of ChemRisk Personnel Interviews
IP Documents from Interested Parties
ST Source Term Information (measurements or information to support estimation)
- **sa** airborne releases
- **sw** waterborne releases
- **ss** releases to the soil

TM Transport Modeling Data (e.g. parameter references or modeling by others)
WP ChemRisk Work Products (plans, reports, calculations, notes, records of conversations)

FILE Shielding Program
Tower Shielding

TO: C. R. Russell, Division of Reactor Development, Washington — July 9, 1953

FROM: Herman M. Roth, Acting Director, Research and Medicine Division, Oak Ridge

SUBJ: MAXIMUM EXTERNAL RADIATION FROM A RADIOACTIVE CLOUD AT A DISTANCE OF 20 MILES FROM THE TOWER SHIELDING REACTOR

SYMBOL: ORB:HFM

In order to furnish additional information for the minutes of the ACRS review of the tower shielding facility, as requested in your teletype RD:E:CRR AEC 1093 dated June 29, 1953, calculations have been made utilising the information given in ORNL-1550.

The total integrated dose received at a distance of 20 miles is given in line 5 of the tables on pages 134 and 135 of ORNL-1550, in units of curie secs/meter^3. This unit can be converted to roentgens, assuming an 0.7 mev. energy for the fission products involved, by multiplying by the conversation factor of 0.44. The total integrated dose from the cloud is shown in table I.

In order to estimate the average dose rate during the cloud passage, the time in which the total dose is delivered must be calculated. Table G-7, p 143, ORNL-1550 gives the concentration on the ground when the activity in the passing cloud is deposited instantaneously on the projected area of the cloud by rainout. If the total activity in the cloud is divided by the concentration, of activity deposited on the ground, the projected cross-sectional area and hence the diameter of the spherical cloud can be inferred, assuming a linear distribution of matter in the cloud.

The time of passage as given in table I can be obtained from the diameter of the cloud and the wind speed at the height of the cloud.

Table I

	Day (Unstable)		Night (Stable)	
	Hot Cloud	Cold Cloud	Hot Cloud	Cold Cloud
Tot. Integ. dose(curie sec/m^3)	.003	.002	.03	.02
" " " (roentgens)	.001	.001	.013	.009
Cloud Area (meter^2)	9.0×10^6	1.3×10^7	6.1×10^5	7.8×10^5
Cloud Diam (meters)	3.4×10^3	4.1×10^3	8.8×10^2	1.0×10^3
Wind Speed (m/sec)	8.0	3.0	7.5	6.5
Time of passage (Minutes)	7.1	22.6	2.0	2.6
Dose rate (r/hr.)	.008	.003	.390	.208
Distance from source (mi)	20	20	20	20

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In checking the calculations, the values for the contamination intensity during rainout, table G-7, p 143 of ORNL-1550 were found to be in error for the hot cloud. The calculation which was originally made did not include the correction for the large size of the source. When the distance plus the distance correction factor (x_0) were used, table G-7 becomes:

Contamination Intensity during Rainout

Distance (Mi)	Activity (a) (curies/m^2)			
	Hot cloud		Cold Cloud	
	Day	Night	Day	Night
1.75 (ARE and HSE)	.123	1.383	.2	.3
2.35 (ORNL)	.089	1.321	.1	.2
6	.079	.995	.02	.4
10	.057	.768	.009	.2
20	.031	.460	.003	.05

(a) Multiply by 10 to obtain r/hr. dose rate at 4.5 ft. above the ground.

The case where a shower or thundershower occurs as a cloud passes overhead is the most hazardous from the standpoint of external radiation. At a distance of about 5.5 miles the dose rate from either of the cold clouds would be about 10r/hr. with a total dose of 50r.

For the cold cloud at night there is a radius of about 2.4 miles in which it would be possible to have a dose rate of 20 r/hr. and a 100 r total dose as a result of rainout.

The corrected values for rainout and the radiation intensity expected from the passing cloud together with the estimated radius of hazard should be considered as additions to the hazard report of the Tower Shielding Facility, ORNL-1550.

ORIGINAL SIGNED BY
HERMAN M. ROTH

Herman M. Roth

CC: Dr. C. E. Larson, C&CCC (2) ✓
Dr. Harry Wexler, WBO, Wash.

Myers:ec